

Data Representation and Reporting, Medical Data Reflection Paper

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C1: Dashboard Alignment

It is important to acknowledge the different diverse backgrounds of stakeholders involved in the data analytics lifecycle. As seen in the data dictionary, the dashboard is ideally designed for executive leaders who do not share the technical background that the data analysts have. Consequently, the dashboard is designed to be user-friendly offering broad and easy to interpret insights from the two data sets, ‘*medical_clean*’ and ‘*Hospital*’ comma-separated values files.

The dashboard is made of four distinct data visualizations: *Readmission by State (Map)*, *Number of Beds by State (Bar Chart)*, *Readmission by Demographics (Stacked Bar Chart)* and *Hospital Status and Capacity (TreeMap)*. Each visualization is designed to communicate information purposefully and be appropriately functional, without being overbearingly technical.

Additionally, the dashboard features two interactive controls located in the upper right-hand corner, allowing users to filter data by state or hospital type, or both. This functionality is designed to enhance the user’s interactivity with the dashboard, specifically the executive leaders to tailor the information display for their specific needs.

The two key performance indicators (KPIs) are *Hospital Capacity Utilization Rate* and *Readmission per Cases*, provide critical metrics one from each data set. These KPIs help summarize the data to make quick assessments of the hospital performance in terms of resource utility such as total beds and patient population and the rate of readmission per ten-thousand cases.

The purpose and function of the dashboard is to assist executive leaders to identify trends and compare metrics effectively and to support informed decision making from data driven analysis. For example:

- I. The Senior Vice President of Hospital Operations will be able to use the dashboard to analyze patient treatments and outcomes across the demographic factors age and gender for many regions to identify areas where intervention is needed.
- II. The Vice President of Research will be able to utilize dashboard to identify patterns in patient care that can inform targeted improvements in healthcare services. These improvements can be based on identifying the utility of hospitals, the readmission rates for initial admissions or where applicable based on the improvements needed from the data provided.
- III. The panel of Regional Vice Presidents will be able to rely on the dashboard to oversee efficiencies and policy implementations at a regional level focusing on metrics like the initial admission and hospital types and hospital capacities, alongside the Senior Vice President of course.

Finally, the dashboard serves as a tool that takes two complex data sets and provides actionable insight, helping executive leaders in their respective roles to better improve patient

care across the hospital network and thus reduce or remove the fines as administered from the *Centers for Medicare and Medicaid Services*, as described in the data dictionary.

C2: Additional Data Set Insights

Using the ‘*Hospital*’ (additional) data set from Kaggle into the analysis with the ‘*medical_clean*’ (provided) data set has provided new insights, compared to using the provided data set alone. The ‘*Hospital*’ data set includes data on hospital beds, patient population, and the types of hospitals in each state which are essential for calculating the hospital capacities. The information from the ‘*Hospital*’ data set complements the patient readmission and demographic data per state found in the provided data set.

By utilizing the ‘*Hospital*’ data set, we can examine the capacities of different hospitals more effectively. The geographical information seen in both data sets, specifically state, allows for the analysis of differences in healthcare services and their correlated readmission rates per state, more effectively. The insight is great for executive leaders like Regional Vice Presidents managing operations across multiple states (regions) as it helps assist in identifying and combating local and regional challenges that may contribute to readmission. Additionally, combining the patient demographic data from the provided data set wither operational data from the ‘*Hospital*’ data set can help in planning for services or hospital additions. This helps in identifying areas where healthcare needs to be reassessed and supports the idea of development of interventions to improve patient outcomes to reduce or potentially remove respective readmission fines administered by *Centers for Medicare and Medicaid Services* (CMS), as described in the scenario in the data dictionary.

Lastly, the integration of the ‘*Hospital*’ data set with the ‘*medical_clean*’ data set provides an insightful view of the current healthcare landscape each with their own helpful data points, providing insights that are better than what is found from either data set individually. This idea is

beneficial for the executive leaders by providing resources to make informed decisions to address the current and future battles with patient readmission as the data changes.

C3: Decision-Making Support

The data visualizations '*Readmission by State (Map)*' and '*Hospital Status and Capacity (TreeMap)*' are each key components of the dashboard, each designed to visualize important factors in patient readmission to help executive leaders make informed decisions. The '*Readmission by State (Map)*' visualization is a color-coded map to display readmission across the United States, including territories such as Puerto Rico. The map highlights the number of readmissions per ten-thousand observations given in the provided data set, providing a geographical view of where hospitals may be currently facing challenges with patient readmission. Executive leaders can use this map for strategic planning to find which regions have high readmission to focus on developing strategies to reduce the readmission rates and their respective fines.

The '*Hospital Status and Capacity (TreeMap)*' visualization groups hospitals by availability (open or closed) and types (e.g., children's hospital, general hospital), offering insight into the distribution of hospital resources such as the number of beds in an open children's hospital. This TreeMap provides operational insight as well, executive leaders are given the opportunity to assess which regions might be experiencing a strain on resources. Additionally, the availability of infrastructure is demonstrated, showing which states have various types of hospitals that other states may lack. This information can help develop strategies to expand current infrastructure and pinpoint both efficiencies and deficiencies in resource distribution. Together these visualizations help executive leaders with data to make informed decisions to improve patient outcomes and operational efficiency and efficacy across the hospital network.

C4: Interactive Controls

The dashboard uses two interactive controls that allow users to filter and adjust the view of the data. These two filters are ‘*State*’ and ‘*Type of Hospital*’. ‘*State*’ is a dropdown menu that allows users to select one or multiple states or view the data for all states found in the provided and additional data sets. It updates all visualizations on the dashboard that depend on geographical data such as the ‘*Readmission by State (Map)*’ and the ‘*Hospital Status and Capacity (TreeMap)*’. Users can focus on the geographic areas of interest or of concern for regional analysis to make decision-making.

The ‘*Type of Hospital*’ filter allows users to select specific types of hospitals found in the ‘*Hospital*’ data set such as children’s hospitals or psychiatric hospitals. This filter refines the data shown in the visualizations like the ‘*Hospital Status and Capacity (TreeMap)*’ which details hospital resources and availability status (open or closed). The filter can assist in assessing how resources are distributed among certain types of facilities.

These filters can help executive leaders drill down specific data views to make informed decisions. For instance, specific states might reveal lack of support for certain health care facilities and thus may be addressed with appropriate strategies. Additionally, the filter by state can determine which states have an increase of challenge with patient readmissions. A final specific for instance, an executive leader can filter by state (e.g. Nevada) and hospital type (Children’s hospital) and would get a drill down view of Nevada children’s hospital data and other state specific data.

C5: Colorblindness

It is important to make the best effort possible to make dashboards accessible for all users, including those with colorblindness. The colors were chosen carefully to thoroughly communicate the results in the data dashboard. The colors chosen seen throughout the entire data dashboard were selected based on visibility to those with the most common types of colorblindness (e.g. red-green color blindness.)

The colors chosen stem directly from Tableau's '*Color Blind 10*' palette. This palette was specifically designed to be easily interpretable by users that have some instance of colorblindness. However, the palette was not readily available for all types of maps, like the geographical map seen in '*Readmission by State (Map)*'. The immediate solution to this was to take the color hex codes from the '*Color Blind 10*' palette and install them into the map manually. There are labels and legends readily available, ensuring that the information is accessible throughout the data dashboard. Additionally, there are many data visualizations within the dashboard that do not necessarily require the use of color, such as '*Number of Beds by State (Bar Chart)*'.

By implementing the design choices, the dashboard makes sure that any executive leaders with colorblindness can still work with the visual data representations throughout the dashboard. This effort is aligned with supporting inclusive decision making and equal access to important information.

C6: Data Representations

Upon constructing the data dashboard, two visualizations were key to the story of patient readmissions and resource utilization across hospitals. These visualizations, '*Readmission by State (Map)*' and '*Hospital Status and Capacity (TreeMap)*' each represent a distinct measure in conveying insight to executive leaders.

The '*Readmission by State (Map)*' helps demonstrate geographical differences in readmission across the United States. By color-coding each state based on the readmission of that state, the map gives a view into the areas that may be facing higher challenges in patient readmission. This helps tell the story where problems lie but also helps set the stage for healthcare strategies, improving old and implementing new, making it essential for understanding the healthcare dynamic across the United States.

The '*Hospital Status and Capacity (TreeMap)*' complements the prior map to enhance our storytelling. By grouping hospitals based on their operational availability (open or closed) and visualizing the scale of the resources available such as beds, this offers a clear view into resource utility and distribution for healthcare effectiveness. Visualization is crucial for planning resource allocation and development such that hospital capacities are utilized in an optimal manner and are aligned with the population of a region to assist in readmission minimalization.

These visualizations together form a story about the challenges and opportunities within the network of hospitals, providing data-driven decisions for enhancing healthcare management and policy making ultimately for the reduction of patient readmission. They illustrate both the current state and room to improve healthcare across different states/regions.

C7: Audience Analysis

Understanding the audience is a vital part to giving a message/telling a story and is how we as humans communicate in our everyday lives. It is important to recognize that the executive leaders are highly knowledgeable individuals for healthcare management, however, may lack the technical background for data analysis. Having this understanding shapes the dashboard to be user-friendly and intuitive, free of technical jargon.

Executive leaders are more interested, or focused on the strategic decisions that must be made that impact patient care, resource allocation and overall efficiency and efficacy. These executive leaders are more likely to be concerned with regulation compliance, reducing costs, and ultimately improving patient outcomes where in this scenario are not mutually exclusive as readmission fines administered by the CMS are for excessive readmissions. It is important that the visualizations directly relate to the executive leader's operational responsibility and goals with the extra effort to include accommodations for those with impairments such as colorblindness.

The executive leaders we assume are tasked with high level decision making and thus require clear and direct information that could be understood without extensive use of the dashboard, however that use of the dashboard is not discouraged, either. With that in mind, visualizations like '*Readmission by State (Map)*' and '*Hospital Status and Capacity (TreeMap)*' were designed to be straightforward. These visualizations were designed to provide immediately accessible insight into important data such as patient readmission and resource distribution and infrastructure.

Additionally, considering that there may exist executive leaders with visual impairments such as colorblindness, the colors were selected from Tableau's '*Color Blind 10*' palette if the palette itself was not immediately available as it was for visualizations like the map. This aids in visual clarity for all members to ensure insightful use of the data dashboard.

Lastly, this approach was audience-centric to ensure the presentation catered to executive leaders needs with relevant and actionable insights, enabling informed decisions that align with the goals of improving patient care to reduce patient readmission and respective fines.

C8: Universal Access

Universal access was an important consideration to accommodate all users, regardless of physical ability or background. To achieve this the dashboard was created with visual design, interactive features, language considerations, device compatibility and extensive user testing.

The dashboard uses colors from Tableau's '*Color Blind 10*' palette to cater to users with color vision deficiencies, ensuring that all visualizations are clear. Additionally, all text elements employ high contrast (dominantly dark) and legible fonts that are sized appropriately for readability.

Interactive elements such as data filters and tooltips help provide information in a simplified manner when changed or selected. This is to assist users who may require more detailed descriptions of the data or who cannot infer directly from the visuals.

The language used in the dashboard is intentionally simple so that it is understandable by non-technical audiences. This involves removing the use of technical jargon and providing clear explanations of the rather complex data sets.

The dashboard is designed with a compact dynamic layout, that is recognizable on a variety of devices, more specifically in the differences between mobile and desktop devices. This ensures universal access across multiple devices, regardless of the device.

The last accessible feature implemented was by means of extensive testing. The development of the dashboard included different phases, adding each worksheet to the dashboard one by one. This testing provided immediate feedback on what worked and what did not. This was important to make iterative improvements to the design of the dashboard.

Lastly, all together through these measures, the dashboard is specifically designed to be universally accessible to promote an inclusive experience to all executive leaders and stakeholders to gain insight from the data to make informed decisions.

C9: Effective Storytelling

With the presentation of the data dashboard, both available from the Tableau workbook and with a simulated Panopto demonstration, I implemented two key elements of effective storytelling to ensure that message was clear with the executive leaders in attendance by giving a step-by-step narrative of this phase in the analysis and with strategic data visualization.

The presentation was designed to follow a step-by-step narrative that started with recognizing the current challenges in the network of hospitals readmissions and the resource allocation and infrastructure. This started with an analysis of the data visualized in the dashboard to demonstrate geographic differences, then operational inefficiencies. The conclusion then made the connection between these insights to provide recommendations for reducing readmission and optimizing or introducing resource use. This was designed to engage with the executive leaders through a logical yet non-technical thought process to support a conclusion that calls for specific recommendations.

Alongside the step-by-step narrative was the application of data visualizations that supported the storytelling. For example, the '*Readmission by State (Map)*' and '*Hospital Status and Capacity (TreeMap)*' were used to represent the issues and solutions discussed in the prior storytelling element along with specific examples. The visualizations were specifically designed to be simple yet intuitive to highlight key points like high readmission states/regions and hospital capacity/utilization issues without being overbearing to the audience. The purpose of the visuals was to engage the audience visually, while working through the step-by-step narrative of the problems at hand. By visualizing such, the significance of the information relayed enhances audience understanding and embraces the call for action.

Finally, these storytelling elements together were significant in the presentation of the problem at hand and the recommendations offered while being informative, engaging and persuasive.

References

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WGU class resources.